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WEST EUROPE REPORT

SCIENCE AND TECHNOLOGY

CONTENTS

QUALITIES OF SEP CERAMIC-CERAMIC CERASEP COMPOSITES

Paris INGENIEURS DE L'AUTOMOBILE in French Nov-Dec 83 pp 77-78

[Excerpts from article by M.B. Malassine, chief of the Composite Products Department of the SEP: "Composites"]

[Excerpt] 6. Ceramic-Ceramic Serasep Composites

Thus, in certain ceramic-ceramic composites developed by SEP [European Propulsion Company], the Cerasep, the cracking and rupture process proved quite different from what occurs in common ceramics or in certain other types of composites: instead of a direct and rapid, and relatively low-energy crack propagation, a far more complex crack propagation is observed, the fibers acting simultaneously as a reinforcement and as a buffer or deflector, with the result that much more energy is required to break such a part.

This behavior implies a lesser sensitivity to internal flaws in the material, thus improving service safety and performance reproducibility, and it leads to spectacular results in impact tests: the considerable difference in the energy absorbed by the composite can be evidenced by submitting a high-performance sintered ceramic and a Cerasep ceramic with a similar composition to mechanical impact.

Some Cerasep ceramic-ceramic composites also offer spectacular resistance to thermal fatigue under conditions as severe as cycling from 100°C to 1100°C, with very brutal air-jet cooling; after 300 cycles, no crack had appeared, even on "wedge" specimens with a very acute angle. Under these conditions, the best performing massive ceramic specimens made of Si_3N_4 or SiC will burst immediately, and even most ceramic-ceramic composites cannot resist and crack after a few cycles.

Such performances are obtained while retaining the characteristics which make massive ceramics so important: for instance, Cerasep composites have a bending strength similar to that of sintered ceramics, with the additional advantage--which we already mentioned--of requiring far more energy before they break. They retain their bending strength even at temperatures exceeding 1200°C, as do the best performing ceramics, and their resistance to corrosion is very good, even at that temperature.

7. Ceramic-Ceramic Composites Manufacturing Methods

A priori, there are many techniques to manufacture ceramic-ceramic composites and most of them are related to the technology of massive ceramics or refractory metals.

- from ceramic powders: a gel or a colloidal suspension are prepared, fibers are coated with the gel or whiskers incorporated into it, a binder is sprayed and the material is compacted by hot sintering or low-temperature diffusion.

- from an homogeneous ceramic alloy: a reinforcement-matrix segregation is obtained through heat treatment. Thus, to obtain glass ceramics, an homogeneous glass consisting of several oxides is heated and a separation of the components caused to occur; it is followed by nucleation, growth and crystallization of small grains in a glassy matrix. The unidirectional solidification of eutectic alloys was also studied, but with much less success than in the case of metallic alloys, due to the high temperatures required with ceramic eutectic alloys.

These techniques have yielded composites with good thermomechanical performances, but most of them have the same drawback as massive ceramics: brittle-type fracture.

On the other hand, the techniques developed by SEP to manufacture Cerasep ceramic-ceramic composites are based on technologies developed to manufacture the Sepcarb carbon-carbon materials, i.e. pyrolysis of ceramic precursors after impregnation of a ceramic-fiber preform, and vapor phase infiltration of the preform.

As an original example, we should mention:

- Gas phase infiltration--developed in particular, in an entirely original and unique manner, by SEP in close collaboration with Professor Naslain's CNRS [National Center for Scientific Research] laboratory--can be used to obtain, for instance, a carbide or oxide matrix.

These techniques can be used over a vast range of applications:

- weaving;

- rolling or layering of the preforms, depending on the dimensions required;

- densification through liquid impregnation and/or gas-phase infiltration, with the possibility of carrying out intermediate machining operations, which are easier to do then than on fully compacted ceramics; it should be noted that SEP has specific industrial tools to produce these carbide or oxide matrix Cerasep composites.

The Cerasep families thus obtained have high mechanical characteristics and their heat characteristics vary according to the matrix and fiber

types; they can be used for a whole range of applications, from insulating to conducting composites.

8. Ceramic Composites Applications

Ceramic composites can be used for a wide range of applications: Diesel and turbine engines, heat exchangers, turbines, missile nozzles, etc.

Indeed, the introduction of the concept of ceramic-ceramic materials has driven back the traditional limitations imposed by the brittleness of ceramics, which make it impossible to use their remarkable chemical inertia or their insulating power, in particular in thermal engines and industrial uses involving repeated thermal shocks.

Parts have already been made by the SEP and tested outside; they demonstrate the progress already made and include, to name just a few, pump vanes, tees, seals, jet control surfaces, turbines, etc.

Many potential applications also exist in traditional land engines (Diesel and supercharged Diesel engines, etc.): isolating or conducting Cerasep composites could be used to improve their performance and longevity (improved output, elimination of piston crown "burning," reduced friction and erosion, and maybe supercharging) as well as their weight breakdown (as cooling systems could become simpler and lighter). It should also be possible to decrease operating noises by reducing the operating play required by the high expansion factor of metals, and to reduce pollution as gases would be at a higher temperature.

Heat losses could be decreased by insulating the combustion chamber and the exhaust pipes, and the chemical inertia of the Cerasep composites that could be used to manufacture piston crowns and valves could make it possible to user lower-quality fuels. Because heat is transferred from the cooling system to the exhaust gases, it might be possible to reduce or even eliminate the cooling system, which would make the engine much smaller and lighter.

As large thermomechanical stresses and, in certain cases, fatigue and impact loads exist in such parts, ceramic-ceramic composites would offer obvious advantages.

For advanced gas-turbine engines--which can be expected to be lighter, more reliable and less bulky than traditional land engines--ceramic-ceramic composites could also be used for high-load components, such as the turbine, combustion chamber, regenerators, which would require no cooling, thus reducing the engine specific fuel consumption, weight and overall dimensions, while improving its performances through a possible increase in the engine operating temperature.

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REVIEW OF FINANCIAL STATUS OF SEP IN FRANCE

Paris L'USINE NOUVELLE in French 23 Feb 84 pp 40-41

[Article by Patrick Piernaz: "Space: The SEP's Concerns"]

[Text] The SEP's accounts are balanced and it enjoys a situation of monopoly; therefore, it should look toward the future with confidence. But every rose has its thorn.

Given that his sales have risen by 14 percent, to 1.38 billion francs, but that his net profit has dropped from 17 to 5 million francs, which he says is mediocre, should Pierre Soufflet, chief executive officer of the European Propulsion Company (SEP), the leading European rocket engine manufacturer, smile or weep?

Among the grounds for satisfaction are the sound position of the company, which is anticipating orders amounting to 2 billion francs, 1.43 billion of which have already been received, and the SEP's position of monopoly (ballistic rockets and liquid-propelled engines for Ariane), so that the competitive sector accounts for only 20 percent of the company's sales.

But this very situation makes the powder propellants and composites division (60.5 percent of the sales) dependent on the Ministry of Defense. After a period of euphoria, the future of the division now appears to be directly dependent on the new ballistic missile programs (the SX missile fired from the ground, and the M5 missile fired from submarines) whose introduction has been postponed to the end of the century. As Pierre Souflet pointed out: "If we do not get the SX development contract in 1986, the engineering department's workload will reach a critical threshold. Especially since the new Hades program (the tactical nuclear missile to replace the Pluton missile) accounts for only 10 percent of this division's activity." Then, SEP would have no other choice than to accelerate its diversification in the composites sector.

Indeed, the company is developing ceramics for the hot parts of engines and is already providing carbon brakes for the Mirage 2000 and Formula-1 cars. But it must confirm its successes and succeed in winning a large contract: that of the Airbus brakes, in cooperation with Messier Hispano Bugati. SEP hopes to get the first Swissair order. But Goodyear is also in the competition...

Another outlet: military applications, with the Dard-120 infantry antitank missile. The U.S. Army is said to be about to place a huge order. But MATRA [Mechanics, Aviation and Traction Company] is out to get the contract for its Apilas system...

In the Distant Future, SEP Could Rely on Its Subsidiaries

The liquid-propellant division (33 percent of sales) is faced with entirely different problems. It has even an overload of work. It must manage to keep up with the Ariane launching schedule: four launches in 1984 and six in 1985. "That objective will be difficult to reach," the SEP chief executive officer believes. "We can produce propulsion units for six Ariane per year, but not all will pass the high-temperature ground acceptance tests."

A paradox: the present overload does not affect equally the engineering department, which is eagerly waiting for the introduction of the new HM-60 engine (90-ton thrust). A huge 4-billion franc program that will provide work for the division for the next 10 years.

The third division (image processing, 6.5 percent of sales) can give back his smile to the SEP chief executive officer: prospects are very promising for this division which builds ground stations to receive and process teledetection satellite images. "Although no satellite of this type is yet in service, we have obtained two large contracts, with Sweden and France, and we are confident that digital image processing will also develop rapidly in the medical sector and for computer-aided design."

In the distant future, SEP might be able to rely on its subsidiaries, two of which show losses (SOLEFIL [expansion unknown] with 32 million francs in sales; and Sept Informatique with 18 million francs in sales), one a profit (Industria with 25 million francs in sales in robotics and welding) and the fourth (S2M [Magnetic Mechanics Company]; 12 million francs in sales) manages to balance its accounts and should experience considerable development. The latter is a medium-size enterprise which is achieving miracles on export markets. Its active magnetic bearings are used in the vacuum pumps of Spacelab and the Japanese space laboratory, in Siemens X-ray tubes, in the German Heyligenstaedt machine-tool spindles, etc. S2M's greatest problem will be to manage its growth well and resist the Japanese thrust.

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BELGIUM TO MAKE VAN DOORNE CONTINUOUSLY VARIABLE TRANSMISSION

Various Cars to Use CVT's

Rotterdam NRC HANDELSBLAD in Dutch 16 Feb 84 p 11

[Text] Tilburg, 16 February--The Volvo plant in Sint Truiden, Belgium, will begin in the middle of this year to assemble the fully automatic gear box for VDT (Van Doorne Transmission) in Tilburg. The contract between VDT and Volvo was signed today.

The innovation in automatic transmissions, the so-called continuously variable transmission or CVT, was developed by VDT. The plant in Tilburg produces the most vital CVT components: the steel thrust clutch belt and the disk shaft units.

The contract calls for Volvo to assemble between 25 and 50 thousand automatic transmissions in a period of 2 years. These transmissions are to be installed in the Ford Fiesta and the Fiat Uno. Ford is expected to begin making the CVT under license from VDT in 1986. Fiat will then buy these fully automatic transmissions from Ford. But a spokeman for Volvo says that it is possible that CVT's will continue to be produced in Sint Truiden even after 1986.

VDT is trying hard to find other consumers. Along with Ford and Fiat, General Motors and Subaru have announced that they want to use Van Doorne Transmission's CVT. During the past 12 years, VDT has invested some 80 million guilders in the development of the CVT. Mass production will begin in Tilburg this year for the first time. Approximately 170 people are employed in the operation. VDT has four stockholders: Volvo with 39.5 percent, Fiat and Borg Warner with 24 percent each and the Netherlands with 12.5 percent.

Background, Funding for CVT

Rotterdam NRC HANDELSBLAD in Dutch 22 Feb 84 supplement p 1

[Excerpts] The automatic transmission of the DAF car was called a Variomatic. Dr Hub van Doorne, its inventor, was ridiculed in those days for his "sewing machine." However, technology does not stand still. In 1984, the Van Doorne Transmission Factory in Tilburg has a successor to the Variomatic which is attracting worldwide interest.

Van Doorne Transmission had developed three types of CVT [continuously variable transmission] for the automobile industry: one for engines with a displacement between 500 and 1200 cubic centimeters, one for engines between 1.1 and 1.6 liters, and one for engines between 1.6 and 2.2 liters.

The Japanese carmaker Subaru is producing the smallest CVT. According to A. Kuve, senior manager in Subaru's Overseas Engineering Department in Tokyo, Japanese interest in the automatic transmission is greatly increasing. In the past year, 40 percent of Japan's cars were equipped with an automatic transmission, but there was not automatic transmission available for Subaru's subcompacts.

Says Kuve: "When we looked around for a suitable automatic transmission, we found what we needed at Van Doorne. They have the most advanced CVT units there in Tilburg as well as the main patents." He says that plans call for introducing the CVT-equipped Subaru Justy on the Japanese market in May or June of this year. Six months or so later, it will come to Europe.

"We want to get some experience in the domestic market before producing large numbers of them," explained Kuve.

He stresses that Subaru will manufacture the automatic transmission solely for its own use for the first 3 years. There might be some changes in this policy later, he says, claiming that almost all Japanese automakers are showing interest in the CVT.

Volvo Car will assemble the CVT for 1.1 to 1.6 liter engines for the first 2 years in Sint Truiden. A total of at least 50,000 transmissions will be built for Ford and Fiat here.

The Italian carmaker introduced the Fiat Uno with automatic transmission this summer. A spokesman in Turin says that two more models with a CVT are planned for the near future.

Ford is coming out with a CVT-equipped Fiesta in late fall. A spokeman for Ford Europa in Keulen has a very simple explanation why the American auto giant has linked up with the tiny Tilburg operation: "We have tried all kinds of systems, and this concept turned out to be the best by far."

Beginning in 1986, Ford will mass-produce the mid-size CVT on its own. For this purpose, the number-two-selling automaker in Europe will invest 55 million dollars in a factory in Bordeaux.

The license agreement between Ford and Van Doorne Transmission will probably be signed shortly. In the future, Ford is supposed to produce automatic transmissions for Fiat as well. A Fiat spokesman states that Fiat has decided not to produce the CVT itself for strategic reasons.

180 Million

Volvo Car in Sint Truiden will continue to assemble the mid-size transmission after 1986 if there is demand. The CVT is suitable only for cars with

frontwheel drive and for this reason cannot be installed in current models of the Dutch automobile plant. A spokeman says that it is very questionable whether the CVT will be installed in the new Dutch Volvo, which will be on the market in 3 years at the earliest.

General Motors has made an agreement in principle with Van Doorne for the production of the largest type CVT. The American firm has earmarked 180 million dollars to outfit its factory in Strasbourg for this purpose.

General Motors manager Robert Annis says that in 1986 production will get underway with a start-up schedule of 300 CVT units per day. This number may be increased to 2,000 units per day in 3 years, depending on demand.

Annis is convinced that the CVT will replace the conventional transmission in the long run. He praises it thus: "Van Doorne's CVT is the best and most practical transmission available today. I don't know of any system that even comes close to it."

Whether the CVT units are made by Subaru, Ford or General Motors, the heart of the CVT, the thrust clutch belt, will be produced in Tilburg. All license contracts make this stipulation. This may be modified in the future if the American firm Borg Warner produces the CVT's in the United States.

However, this is a present only tentative. The first CVT's will hit the American market no earlier than 1987, and these will be of European manufacture.

The man who spurred the development of the CVT in the Netherlands is Dr Hub van Doorne, one of the founders of the DAF firm. He invented the Variomatic, the automatic transmission with a rubber belt that gave the DAF car its nickname 25 years later: the sewing machine.

There was much ridicule surrounding it in those days, but experts think the concept was brilliant, although it encountered major difficulties in practice. The unit was larger than the motor. It was suitable only for small engines, and the rubber belt was always breaking. The improved version, the Transmatic, is still installed in Volvos but it too has the disadvantage of being excessively large and unprofitable.

For this reason, people have tried hard to come up with a smaller and improved CVT. Two new versions were designed in the Netherlands: one at Van Doorne Transmission in Tilburg, the other at the development firm of CCM in Neunen, an operation owned by A. Horowitz, an engineer and inventor of the Philishave.

Steel Chain

M. Cuypers, engineer and senior staff member at the Technical University in Eindhoven, succeeded in interesting Horowitz in a CVT with a steel chain. Horowitz also conducted research at his CCM into another kind of CVT, one equipped with a steel chain belt. German firms have focused on this type of

automatic transmission as well. Cuypers says that the explanation for this is simple: "Van Doorne Transmission has a monopoly on the CVT with a metal band. The set of patents held by Van Doorne and Volvo is so complete that the others have difficulty in using the concept. They are therefore forced to find another way."

Cuypers says that both types of automatic transmissions have their specific advantages and disadvantages. Van Doorne struggled for a long time with the reliability of the steel band. It seems that this problem has been solved now. I think that was a major accomplishment, a posthumous tribute to Dr Hub van Doorne."

Cuypers says that it is "no sure bet" that the CVT with a steel band will become the transmission of the future. "We'll have to see how it works in practice, but the Van Doorne CVT is the only one available for the present," says Cuypers.

It will not be that way much longer if CCM can help it. Director J. Kummeling claims that the firm in Neunen has made more progress in the field of chain CVT's than any of its competitors and now has a chain that is almost ready for commercial production. Says Kummeling: "We are at a point now where we have to take action." CCM is talking with various companies. Any contracts will stipulate that at least one-half of the chain production must be carried out in the Netherlands, says Kummeling.

"We still have a headstart," responded J. van Ham, director of Van Doorne Transmission, "but it's anything but comfortable. We're far from that. We have demonstrated that we can design an outstanding transmission but we must still prove that we are a dependable manufacturing operation. We'll also have to keep working on improving the CVT. We'll have to discover more applications for it, too."

After the company spent some 80 million guilders over the past 12 years, those who hold stock in Van Doorne--Volvo Car with 39.5 percent, Borg Warner and Fiat with 24 percent each and the Netherlands with 12.5 percent--can now think about gradually earning it back.

The Tilburg factory has well over 100 million guilders worth of back orders for the next 2 and one-half years. After this, the truly big orders will probably come in. Van Doorne Transmission is starting modestly this year with a production of 25,000 steel bands for the CVT, to be increased to 70,000 bands in 1985.

Van Ham foresees a steady growth, mounting to "staggering numbers in the early 1990s." He predicts: "Maybe as many as 6,000 to 8,000 bands per day. After all, one-fourth of the 34 million cars manufactured in the world each year have an automatic transmission. We're bound to capture a major portion of this market. How rapidly this happens, depends on how hard the carmakers try to market the CVT."

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GERMAN BIOTECHNOLOGY COMPARED TO AMERICAN

Duesseldorf VDI NACHRICHTEN in German 16 Dec 83 p 20

[Excerpts] It is to be assumed that biotechnology and gene engineering will, during the coming years, contribute to many new solutions, such as in the area of nutrition, environmental protection, pharmacy, or raw material procurement. The author of our series, Doctor of Engineering Hartmut Frey is afraid, however that German industry will find it difficult to catch up with the United States in this promising field.

In view of these facts and future outlook, one may be justified in predicting that biotechnology and gene engineering during the remaining 17 years of our decade will achieve similar revolutionary significance as microelectronics have today or as chemistry had during past decades.

The products of West German chemical enterprises today are among the world's top products. In addition to the American concern of Du Pont, Hoechst, Bayer, and BASF [Baden Aniline and Soda Works] are among the biggest in their branch. It is at this time still questionable whether they will be able to salvage their predominant position as we go into the age of biotechnology.

Professor Paul Praewe, chief of biotechnology at Hoechst, describes the situation as follows: "I would like to answer the question as to whether we in Germany can keep up in the following terms: It would naturally be very much easier if the Europeans could do this together. But this seems to be something which will take quite a few years, if not decades. Nevertheless, I believe that, in terms of equipment and personnel, we in Germany as so well equipped that it will be possible to achieve something with a few formal changes--although this is not seen in most instances, I do believe that this will happen--and that we will after all be able to keep up. The research base exists and in the final analysis there is no shortage of money either even though it might look like this on occasion in the press."

Professor Hubert Koester, a biochemist at the University of Hamburg and founder of one of the very first West German gene engineering enterprises, recognizes certain omissions: "Basically, too little has certainly been happening here in West Germany for a very long time. It appears that it was especially the significance of biotechnology and gene engineering which was simply

recognized here too late and therefore industry simply did not see the need for either developing this knowhow itself or obtaining it through cooperation with research institutions in which this knowhow exists."

We in the FRG have already gotten an initial impression as to the tempo with which biotechnology is being pushed in the United States. For about a year now, Eli Lilly has been selling, in the FRG, insulin produced by means of gene-engineering. Until now, pharmacists had to process a ton of pancreas taken from thousands of head of beef cattle and hogs to get 100 grams of insulin, that hormonal life support of diabetics. Today, something similar is being done in a completely bloodless manner in fermentation towers.

In contrast to the product derived from slaughter animals, the hormone, made by gene-engineering methods, corresponds exactly to the insulin that is secreted by the human pancreas. This is why it also causes less side effects, as clinical tests proved. Around 420,000 diabetics in [West] Germany depend on the vital hormone which regulates the blood sugar level in the body. Worldwide, the sales volume of the insulin market is more than DM700 million.

Although German chemical firms are energetically expanding their gene-engineering research, it will take some time before they have caught up with the Americans, provided this is possible at all; in the meantime, the Americans will not be asleep at the switch either; more than 200 larger and smaller biotechnology firms are already providing dynamics on the gene front. Robert F. Santerre, of Eli Lilly, the pharmaceutical concern, said: "The small biotechnology firms play an insignificant role on the market for biotechnology and gene engineering products; the situation however is different when it comes to building up the innovation potential of biotechnology and gene engineering. This is where many of these small firms play a key role. Leading scientists, such as, for example, Nobel Prize winners, are no longer finding it particularly attractive to go into big industry. They prefer to work in smaller biotechnology firms which have established themselves near the universities. The best biotechnicians and gene engineers are as a matter of fact working in these small enterprises. It is therefore particularly far-sighted on the part of big enterprises, such as Eli Lilly, to support such small firms in order later on to acquire the new knowledge developed there."

What the Americans so eagerly pursue is something the Japanese do not want to miss out on either: A short time ago, Japanese chemical companies began investing large amounts in the establishment of biotechnology plants. Whatever the Japanese have yet to catch up on here and there in basic research, they are now purchasing. If the Japanese can catch up in basic research, they will very soon have overtaken their foreign competitors in biotechnology; this is because nowhere in the world do enterprises have as much experience with traditional biological-industrial processes as in Japan. Because of Asian nutrition habits, the Japanese essential foods industry has a perfect mastery of fermentation processes. (To be continued)

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STATUS OF BIOTECHNOLOGY IN ITALY

Duesseldorf EUROPA CHEMIE in German 15 Feb 84 p 72

[Text] An inventory survey of biotechnology in Italy was submitted on 3 February to representatives from industry, research institutes, and government agencies by FAST, the Federation of Technical-Scientific Associations. The report is the result of a survey among 142 public and private research institutions. Italy's presence in six fields of activity was investigated.

Accordingly, 86 research groups are active in the field of gene engineering, 22 are concerned with monoclonal antibodies, ten, each, are working on vegetable cell cultures and enzymes, 11 are active in protein chemistry, and three are working in the chemistry of oligonucleotides. The following were especially emphasized: The Milan Cancer Research Institute, the Negri Pharmaceutical Research Institute (see EUROPA CHEMIE, 1-2, 1984, p 19), ENEA [National Agency for Alternative Energy Sources], and the Casaccia Grain Research Institute.

Eight enterprises are engaged in biotechnology research and development:

Gene engineering: "Farmitalia-Carlo Erba SpA," Assoreni (Research Company of the state-owned ENI [National Hydrocarbons Authority]) "Group Lepetit SpA" (Dow), and the Cesare Serono Research Institute (Research Institute of the "Serono Pharmacological Institute SpA" [Incorporated]);

Monoclonal antibodies: Lepetit, "Sorin Biomedica SpA" (Fiat), as well as "Recordati Chimica e Farmaceutica SpA" and "Istituto Sieroterapico e Vaccinogeno Toscano Sclavo SpA," (both of them with Enichimica);

Vegetable cell cultures: Assoreni;

Immobilization of enzymes: Sorin Biomedica, "Soc. Prodotti Antibiotici SpA" (Searle partnership), and Assoreni;

Protein chemistry: Sorin Biomedica, Farmitalia-Carlo Erba and Assoreni.

No enterprise is active in the field of the chemistry of oligonucleotides.

It was recognized that there is certainly no shortage of enterprises and research installations in Italy which are engaged in biotechnology research and development. But the report criticizes the fact that there is perhaps a lack of specific goal concepts and also financial resources. The government in 1983 thus did not even spend 7 billion Lire for this purpose. The presentation of the FAST Report produced satisfaction over the fact that, in addition to New Delhi, Trieste is also to become the home of the International Biotechnology Center being planned by UNIDO (United Nations Industrial Development Corporation). Italy will make 63 billion Lire available to finance the research installations in Trieste, including 34 billion Lire through the Development Policy Department of the Foreign Ministry, plus 29 billion Lire to the consortium founded for this purpose in Trieste. Research Minister Luigi Granelli announced that he will create two study groups in his ministry, one for scientific-industrial and the other one for economic-legal questions involved in biotechnology. To avoid duplication of effort, these groups would cooperate closely with the Permanent Biotechnology Committee of FAST.

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RESEARCH, INDUSTRIAL BIOTECHNOLOGY IN NETHERLANDS

Rijswijk PT AKTUEEL in Dutch 30 Nov 83 pp 3-4

[Article by Bert Bosker: "Netherlands' Chances in Biotechnology Are Fair: Record of Success No Higher Than That of Other Technologies"]

[Excerpts] The Dutch Biotechnological Association (NBV) last week celebrated its first anniversary with a symposium featuring an updated survey of biotechnology in our country. Under the motto "An Objective Look at Biotechnology," the association took the occasion to marshal all the facts at a press conference and attempted to correct somewhat of a misunderstanding about biotechnology. What can biotechnology do? And what are the prospects for Dutch industry in this field?

Dutch Industry

Dutch industry has often been reproached over the past years for being behind in the development of biotechnology. As a matter of fact, however, it seems that industry in our country is doing what it should to prepare for the opportunities offered by this technology. This is of course primarily true of the two giants Gist-Brocades and Heineken. Gist-Brocades deals in yeast, alcohol, antibiotics, enzymes and refined chemicals, and Heineken has 7 percent of the world beer market.

The records of Dutch businesses are also noteworthy in their standing as producers of biotechnological products for the world market. Gist-Brocades ranks first as a producer of penicillin and second as a producer of enzymes. The Avebe Potato Cooperative is Europe's major source of farina, and its affiliate Glucona--with Akzo Cehmical--has the largest share of the world market in gluconates. Chemie Combinatie Amsterdam, a CSM affiliate, is the world's major source of lactic acid. Duphar is the largest producer of influenza vaccine in Western Europe. Of the total sales of Dutch industry, the food industry claims 25 percent, and biotechnology claims an estimated 15 to 20 percent. The Netherlands is the world's leading exporter of cheese, with sales exceeding even those of beer by 10 percent.

In the refined chemicals and pharmaceuticals sectors, Akzo-Pharma offers a wide assortment of steroids, diagnostics and veterinary vaccines with notable innovations. It won two world firsts in the new biotechnologies: a monoclonal

pregnancy test and veterinary recombinant-DNA vaccines for diarrhea in calves and farrow pigs.

Another innovator is DSM [Dutch State Mines] a company that is diversifying into the refined chemical market with immobilized enzyme processes.

The production of vaccines has been extensively developed in the Netherlands by three exporting multinationals in the veterinary sector: Duphar, Zeew/Gist-Brocades and Intervet/Akzo-Pharma. Two national institutes, the National Institute for Public Health and the Central Veterinary Institute, are the Netherlands' sole suppliers of, for instance, vaccines for diphtheria, whooping cough, tetanus, polio, measles and hoof and mouth disease.

Naturally, not all that glitters is gold. The production of citric acid by Akzo in Deventer was discontinued a few years ago, Scholten-Honig went bankrupt with the isomer process in England and Avebe is having serious financial problems as a result of high clean-up costs.

The Netherlands has traditionally played a leading role in the field of waste-water treatment. In the 1950s, the aerobic system of the oxydation ditch--the so-called Pasveer ditch--was developed by TNO. DSM built the largest aerobic water treatment plant in Europe based on its own technology, and Schell in Pernis recently placed a large aerobic water treatment facility in operation. The anaerobic method of water treatment has been gaining momentum in our country because of the new continuous upstream reactor [as published] developed by LH in Wageningen, TH in Delft and CSM [Central Sugar Company].

Large-scale applications have been made in the sugar, potato flour and alcohol industries as well as in several municipal water treatment plants. A second generation of anaerobic bioreactors with immobilized micro-organisms is in the pilot stage at Gist-Brocades.

As a result of the government's Innovation Bill, the Program Committee for Biotechnology (PCB) was established in the Netherlands in 1981. This has recently set up the Research Program for Innovations in Biotechnology, for which the Ministry of Economic Affairs has 70 million guilders at its disposal through 1988 for stimulating research in the field of biotechnology. The committee has selected seven fields of application that offer good prospects for the Netherlands. These seven fields are as follows: biological waste processing, biological waste treatment, the fermentation industry, refined chemicals, human and animal health care, refinement of agricultural and horticultural plants, and the industry for food and allied products. This program should help our country to maintain its advantage in some areas and to catch up in others where we may be behind.

The European Federation of Biotechnology, which celebrated its first anniversary this year, conducted a technology assessment study commissioned by the EC in which it reviewed the prospects for the next 30 years of all the basic disciplines and areas of application of industrial and environmental biotechnology.

The commission assessed the prospects for biotechnology in Europe as follows: good chances for pharmaceuticals and refined chemicals for the next 5 to 10

years, fair chances for livestock feed and enviromental control and some chances for human foodstuffs for the next 10 to 15 years and limited chances for raw materials for the heavy chemical and energy industries for the next 20 to 30 years. On the basis of this and other contracted studies, the European Commission has received the go-ahead from the EC ministers for a program targeted on biotechnology.

This will address itself to two major bottlenecks in European biotechnology: the prices of raw materials for the fermentation industry--those of sugar and farina--are supported in the EC at levels above that of the world market. This unfavorably affects the price level of European fermentation products, whose prices can be as much as 50-percent determined by the raw materials costs. It is crucial for the further development of European biotechnology that the raw material prices be maintained at the world market level through regulation.

The major problem of the EC--i.e., the agriculture surpluses of dairy products, grains and sugar--exists vis-a-vis the large imports of wood, protein for animal feed and vegetable oils. Studies are trying to determine what role biotechnology can play in the valorization of these agriculture surpluses in the light of this imbalance.

The Netherland's Chances

Considered against the background of Europe's prospects in the several areas and the plus-minus analysis conducted by PCB, the Dutch Biotechnology Association regards the prospects for biotechnology in the Netherlands as favorable. The association estimates the prospects for the future as follows. Over the short term, pharmaceuticals and refined chemicals are considered to be growth industries. In this however, our traditional strengths are not as great. The innovating pharmaceutical industry in the Netherlands has been reduced to Akzo Pharma and Duphar. In international terms, their size is average to small. Both have relatively small biotechnological interests. The dominant position of American genetic engineering is also a threat. It will require great effort and inventiveness to profit in even a small way from the first wave of products. The expected growth in biotechnological pharmaceuticals will then be limited in the Netherlands too.

The heavy chemical industry has traditionally been strong in the Netherlands, and that of refined chemicals has been limited. A large dose of scientific and commercial effort will be necessary to promote the prospective growth of biotechnical refined chemicals in the face of this situation. The prospects are more favorable in the relatively strong fermentation industry, the biotechnical pharmaceuticals--antibiotics, etc.--and refined echemicals--enzymes, steroids, etc.--manufactured on a large scale by such companies as GB, Akzo Pharma/Diosynth and Oce/Andeno.

Those areas where opportunity exists over the next 10 to 15 years--livestock feed, environmental control and human foodstuffs--offer moderate prospects for the Netherlands in livestock feed and favorable prospects in environmental control and human foodstuffs.

The Dutch chances are better in the area of refining agricultural waste to single cell protein. The technical development is well underway, and economic considerations will determine whether agricultural waste is to be converted into single cell protein rather than into biogas, or into both.

Environmental biotechnology has been thoroughly developed in the Netherlands and can lead to further applications sooner than elsewhere in Europe.

New developments in food and allied products are strongly determined by consumer-protection laws and consumer conservatism. The inventiveness of Dutch industry will be challeneged to exploit the biotechnological potential of this field.

This is in general a fairly optimistic picture. It must be said that alertness will be extremely important in the rapidly innovating and very competitive field of biotechnology in the 1980s. The technical and economic prospects are highly dependent on a neutral or positive attitude of the public toward biotechnology. Public acceptance of such new technologies is very hard to calculate and could work to upset projections.

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FINLAND'S INDUSTRY TURNING TO BIOTECHNOLOGY

Helsinki HELSINGIN SANOMAT in Finnish 28 Feb 84 p 4

[Article by Heikki Arola: "New Industry with Genes: the Finns Are in Touch with Biotechnology Development"]

[Text] After a slow start people in Finland are also experiencing more and more interest in the rapidly developing area of high technology, gene and biotechnology.

The most recent newcomer in the field is Bertel Ekengren, Bachelor of Science in engineering and owner of the firm EKE, which has grown tremendously in recent years in construction on the Eastern market. Ekengren has established his own gene laboratory with three researchers near the gene institute of Helsinki University.

At present the frequently used "high technology" is fairly vague as a concept, but gene technology clearly belongs within its confines.

Gene technology is based on biological research which has evolved rapidly in recent decades. Scientists have thrown light upon the structure of genes and cells and have learned, for example, to transfer human genes to bacterial cells.

Knowledge has increased manyfold during the last ten years. It is already beginning to have industrial and commercial significance.

At this moment no one is able to predict all the possibilities which the new technology may have in the future, but the prospects are generally considered promising.

Importance may be enormous both in industry and in the life of the private human being. The most courageous think that gene technology will promote the same kind of revolution as plastics did in the 1940s, transistors in the 1950s, computers in the 1960s and microprocessors in the 1970s.

From Drugs to Timber Processing

Gene technology may be utilized in the future in various fields, from the pharmaceutical industry to the food and timber processing industry.

By transferring a certain gene to a bacterium one is able to get the bacterium to produce substances which it did not produce before, for example, animal and human cell albumins, or proteins.

For the time being the pharmaceutical industry is the only one which uses the method in production. Previously the bacteria in factories produced only insulin secreted by the human body and interferon.

The foodstuff industry could begin to make proteins suitable for nutriment. The Finnish forest industry hopes that with the help of gene technology it will be able to process raw materials of fodder from the residual substances of sulfite cells.

Slow Start

Compared internationally, Finland got a late start in gene technology and is still considerably behind.

In Finland planned research, the kind to be taken seriously, began 3 or 4 years ago. In the United States it was begun about ten years ago.

Last autumn a gene-technology institute opened at Helsinki University. The office of institute director was created with a donation by Neste and Kemira.

Seven firms which have an interest in the field have now established a combine named Genesit, Inc., which is financing a special project at the institute. The firms are Neste, Alko, Valio, Metsaliitto,Suomen Sokeri, Orion and Farmos.

The goal of the project is to develop a supply of bacteria with the help of which the desired proteins can be produced. Worldwide demand should be almost unlimited.

There are few experts in the field in Finland. Working as researchers in the field are mostly microbiologists, biochemists, geneticists and physicians.

Swedes Rush Forward

As is their custom, the Swedes are rushing forward with vigor in this field, too.

A couple of weeks ago the recently established firm of Skandigen, which concentrates purely on gene technology, bought from the United States a bacterium which produces antithrombin, a drug which prevents the coagulation of blood. The seller was the world's leading firm in the field, Genentech in San Francisco.

California in particular is the center of this field, too, just as it has been in electronics.

The Swedish Skandigen received in the deal the sales rights of antithrombin everywhere except in the United States and Canada. At the same time Genentech became a shareholder in Skandigen.

Earlier the Swedes had purchased six percent of the stock of Genentech, and a Swede sits on the company's board of directors, so that the Swedes really have a good spot to view the development of high technology.

Great Expectations

The director of the gene-technology institute, Doctor of Medicine Leevi Kaariainen, also believes in the future of the field, but nevertheless warns against expectations which are too great.

"In America the outlook is painted in charming colors. Undoubtedly there they've gone to extremes, at least as seen from here."

Kaariainen sees the American economic system as an explanation for the relentless ballyhoo surrounding this field in the United States. After all, over there many of the several hundred developmental companies in the field are stock-exchange companies, which are seeking capital from the markets by all possible means.

"There is a lot of discussion about the matter, you are bombarded by the press, all the minor inventions are keenly noted. In Finland the situation is completely different, but the waves from there are reaching here.

"In the United States people remember well the tremendous development of electronics. Because of that, this is doing well now, the speculators want to be in on the action, if it should be as successful...

"Personally, I would hope for an industrial peace of several years, let's say three years, after which people could have a look at what had been created.

"The possibilities are, as I said, enormous, but you would need to be an unbelievable genius to be able to outline them now..."

Kaariainen also believes that a true period of application will not dawn until the next decade.

Our Firm

Bertel Ekengren says that he gets involved in research activity "in order to increase knowledge of the field in Finland and in our firm."

The researchers hired by Ekengren work as an independent group, but they are in close collaboration with the university's gene-technology institute.

Ekengren says that "for the time being" he has no plans for how the company could make use of the new technology. He rattles off, however, four areas in which the possibilities for industrial application are the best.

They are medicine, decontamination of wastes, more economical exploitation of raw material resources than before (for instance, third use of oil wells), as well as nutriment synthesis, or preparation of foodstuffs.

Ekengren's EKE firm has concentrated on construction projects of high-technology level. Ekengren's product of the future could thus be a waste-decontanination plant equipped with more efficient decontamination methods than previously.

'We Were Among the Best'

Bertel Ekengren is clearly annoyed by the publicity he and the firm have incurred since the contract competition for the Tallinn harbor was settled in December.

EKE, which competed with large domestic and foreign construction concerns, came away with one-fourth of the contract, a chunk of 250 million marks.

The interest of the press grew when it was noticed that the firm had enlarged tremendously in three years, from a turnover of 50 million to several hundred million marks. Nearly the entire turnover springs from construction in the Soviet Union.

Ekengren was called a sensational builder in the press. He does not want that kind of reputation. "The simple truth is that in the Tallinn case we were among the best technically."

Nor does he want any unjustified credit for himself in gene research. Several times he calls attention to the fact the most important initiator in Finland is Chancellor Nils Oker-Blom of Helsinki University.

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UNESCO OFFICIAL ON BIOTECHNOLOGY IN DEVELOPING COUNTRIES

Paris BIOFUTUR in French Feb 84 pp 31-33

[Interview with Albert Sasson, member of the UNESCO Studies and Programmation Board, by Edith Herdhuin: "Biotechnologies and the Third World"]

> [Excerpts] The policy of aid must change: "giving" must give way to "teaching." Teaching developing countries to become self-sufficient, to make better use of existing resources, to use new technologies that may help them get out of the hole.
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> Mr Albert Sasson, member of the UNESCO Studies and Programmation Board and the author of "Les Biotechnologies, défis et promesses" [Biotechnologies, Challenges and Promises] (UNESCO, Sextant series), is expressing his views on the problems and demands which determine the use of biotechnologies in developing countries.

"Turnkey Biotechnologies"?

In the adventure of biotechnology, there is a great danger that one part of the world will remain passive and powerless and watch as industrialized countries are fiercely competing to conquer markets. Too often, when industrialized countries give food to poor countries, they are doing so just as a means to get rid of surplusses. Too often, Third-World countries are considered from the point of view of their exploitable resources, not of their needs. It is high time to consider how the Third World could share in the development of biotechnologies, what benefits it could derive from it, and also what specific contribution it could make. Developing countries should also be actors, not just spectators of the biotechnological revolution. And generously transferring "turnkey" biotechnologies "as is" is not enough, as this could lead to serious "rejection" crises for a variety of reasons: ignorance of the geographic and social environment, inadequate material and "human" infrastructure, ill-will on the part of ill-informed governments.

Transfer Problems

Biotechnologies cannot be transposed directly: a biotechnological application will not be the same in a humid tropical zone or in an arid one, in an agrarian

or in an industrial society. Above all, the historical and economic conditions which cause industrial countries to develop a given biotechnology will obviously not be found also in a developing country. However, many shortcuts exist to adapt biotechnologies to the environment where they are needed. But a biotechnological application should not be imposed without consideration of traditions, cultures as well as government's desire, without which nothing can be achieved.

Once this is accepted, procedures must be defined. How can we transfer biotechnologies? How can we identify and make an inventory of a country's needs? What is the most effective way of training? On location or at foreign universities?

If we accept the principle of dialogue, and especially the principle of equal needs, should not international cooperation reconsider its role? We soon notice that there is not one, but many biotechnologies that are adapted or adaptable to Third World countries.

"The Other Side of the Coin"

Paradoxically, biotechnologies can harm developing countries before they help them. Actually, biotechnologies are too often perceived in industrial countries as means of further increasing productivity and obtaining new products or products that can replace imports. Whence the risk, on the one hand, of creating sophisticated biotechnological systems which cannot be adapted in developing countries and above all, on the other hand, of creating a dangerous competition for Third-World exports.

Let us take the case of sugar. The large-scale production of isoglucose from surplus corn in the United States since 1974 has been a disaster for countries whose economies depend in part on the sugar market (e.g. Mauritius where sugar cane is the single crop, or Brazil). Sugar prices have never been so low. Of course, we cannot prevent the production of synthetic sweeteners. But countries now producing sugar as a single crop could diversify their agriculture and other uses could be found for the excess crop. In that case, a reversal of the situation could make biotechnologies beneficial again. For instance, Brazil is producing ethanol, which will be used as a fuel, from the fermentation of cane sugar. In the case of the Alcohol in Brazil Program, biotechnologies were obviously the solution. A sort of dynamics was created between favorable conditions (surplus raw material), an appropriate technology (alcoholic fermentation) and economic control. In Brazil, the alcoholic fuel is more expensive than gasoline. But if we consider that the raw material consists of waste or surplus that would be destroyed, and that Brazil has an $ 87-billion foreign debt, due in part to its oil imports, the alcohol program goes beyond mere economic logic (cost price) to become a sensible policy.

In the long run, biotechnological industrial infrastructures will improve (better-sized plants, improved bacteria performance). Experimental research may lead to the creation of an advanced technology. If there were no political incentive (in this case, the need to achieve national independence) the economic criterion ("too expensive," "not competitive enough") could work against new applications. Japan is a good example of success: all it wanted

was to overcome its dependence on the United States with respect to electronics. It became the United States' leading competitor.

National Independence

National independence is also an incentive to the development of single-cell proteins (SCPs) to be used as animal feed. Several European countries have already built SCP plants with production capacities of over 100,000 tons (ICI [Imperial Chemical Industries], Great-Britain) to reduce their soybean imports. But this too can be detrimental to developing countries, as the SCPs can cause their soybean exports to decline. Developing countries may rely on their soybean exports to balance their payments. For instance, as far as soybeans are concerned, Brazil has become a leading competitor of the United States. But, in that case too, the situation can be reversed. The protein content of manioc can be increased through fermentation, as the proteins of the fermentation microorganisms are added to manioc proteins. In Colombia for instance, the International Center for Tropical Agriculture (CIAT) has produced experimentally protein-enriched manioc (with a 49-percent rate of enrichment) which is well tolerated by animals. On Brazilian farms, next to soybean or, more recently, manioc plantations, small-size fermenters can be seen whose products are used as animal feed. Soybeans are used on location more profitably. And, later, the new products could also be exported (enriched feed).

Local Tradition

A good knowledge of traditional foods and traditional agricultural methods is indispensable to make good use of biotechnologies. Sometimes, solutions can be found on location. For instance, Asiatic populations have always used foods enriched with single-cell proteins: the Indonesian tempeh (a fermented soy paste with a 55-percent protein content), the Javanese bongkrek (coprah cakes), the Japanese miso, all are rich and economic foods. This should be a lesson for advanced technologies: simple and available solutions are often the most profitable, and the United States are now considering dressing these foods to suit modern taste.

History and Policy Also Play a Part

The implementation of biotechnologies often has a modest and not very "scientific" origin. This is true of the development of microbiology in Japan. In the 19th century, the imperial government decided to levy a high tax on sake, the rice alcohol. To pay the tax, the peasants had to grow more rice. Rice thus became practically a single crop and the only food of the Japanese, who tried to make eating it less monotonous. They developed microbiology, which they used to call "agricultural chemistry."

This is why Western biotechnologies found in Japan people with the right mentalities, techniques that were already developed and suitable raw materials.

Another example of the important part played by environment and sociocultural structures is the production of biogas from waste products; it was developed in two countries, India and China, because many favorable factors existed there: large areas, a rural population, no "noble" raw energy sources, no

foreign currency to buy oil, a lot of waste products. However, the experiment was not equally successful in the two countries. In China, the implementation of digesters for the production of biogas was a success because of the socio-economic and political context. The existence of small rural communities with rigid structures made it possible to install either family or collective digesters. At the same time, a large-scale training policy was implemented. In India, the success was not as great, probably due to sociocultural and economic factors rather than to technical factors. However, like the Brazilians with alcoholic fuel, the Chinese and the Indians acquired invaluable knowhow and made original observations on methanic fermentation, which can compare with the discoveries of the most famous research centers.

This experiment could benefit many countries if an international cooperation policy was implemented not only between North and South, but also between southern countries. What is needed to succeed is waste products, water and a local industry able to produce vats, and these conditions are met in many tropical and equatorial countries, and in certain industrialized countries as well... which could also use them! In this case again, habits, silence and inertia weigh heavily. A lot of accumulated knowhow is lost just because it is not shared.

The Art of Cooperating

These examples clearly show that, despite their potential riches, or rather because of them, Third-World countries cannot do everything all by themselves.

But they should not be restricted to a sort of "under-biotechnology," "noble" research being left to advanced countries. International cooperation should not be the unilateral development of local resources. It must rest on an exchange of knowhow and raw materials, based on the transfer not only of materials, but especially of knowledge. This is the goal of UNESCO, which organizes teachers' exchanges and short but highly specialized student's training periods.

In the long run, training on location appears to be the best solution. University infrastructures already exist in nearly all developing countries. A good researcher must be trained on location, familiar with local difficulties and aware of his country's specific problems. Only then should he go abroad to find solutions. The same applies to researchers in industrialized countries, who can only profit by coming on location to see what is going on. That will give them a better idea of the problems encountered.

Suggestions

Concretely, several suggestions can be made. In France, the Mobilization Program started in May 1980 provides for the "identification" of teams of teachers and researchers in all countries, whose search could be "reactivated" by assigning it more concrete goals that would be better adapted to the country's needs. The twinning of institutions should be encouraged. The Pasteur Institutes in tropical countries are doing remarkable work with local researchers.

In the long run, we could consider the creation of regional research centers covering several countries with identical concerns: for instance, a center specialized in research on alcoholic fuel could result from the Brazilian experiment; another could specialize in the production of vaccines against tropical diseases; still another in variety selection through plant-tissue culture.

We should not be overambitious, or our noblest intentions could come to nought before they materialize. Structures already exist; all we should do is specialize them and increase their means. Models exist which work well; for instance, since the 1960's, the International Agronomic Research Centers sponsored by the FAO.

The most important thing to do may be to change the way men and women in developed countries see the world. We are no longer at the center of the world. New live forces are emerging, and we need them. Cooperation must turn into collaboration, and the North-South dialogue must also listen to the South-South exchanges which are beginning to be heard.

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INTERVIEW WITH PHILIPPE KOURILSKY OF PASTEUR INSTITUTE

Paris SCIENCE ET AVENIR in French Jan 84 pp 29-30

[Profile of Philippe Kourilsky, department head at the Pasteur Institute, by Stephane Deligeorge: "The Polytechnic Graduate in Genetics"]

[Text] A graduate of the Paris Polytechnic, he is, at 41, department head at the Pasteur Institute, advisor on the "Biotechnologies Development" program and scientific advisor to Transgene.

Philippe Kourilsky will be the first of the models whom we intend to present in these columns in 1984. Philippe Kourilsky is a high-level official of the Pasteur Institute, a biologists that is, one of those whom the non-scientific press would be inclided to call an ambitious young molecular biologist. He speaks softly, precisely, without a trace of pomposity. This young department head--he is in his early forties--is truly humble. During our interview, he was not modest for the sake of appearing modest and when, as could be expected, we asked him about his vocation, he did not serve us a few ready-made sentimental considerations on his childish admiration for butterflies and the mysteries of life. Then, why biology? "By inclination, by reason, what do I know? I studied mathematics, I am a graduate of the Polytechnic School. I stayed there two years, like everybody else, and when I graduated in 1964 I decided to do biological research. At the time, it was not very common, although a few others had already done so."

At the time, Jacques Monod had decided to recruit Polytechnic graduates. He must have thought that training in mathematics would become essential in certain exact branches of biology, molecular biology precisely. "We knew that we could go see Monod to get information. This is what I did," Kourilsky explained. "Monod was a very interesting man." Thus, Philippe Kourilsky joined the laboratory of Francois Gros, a student of Monod, who had worked at the Pasteur Institute. There, he prepared his thesis on bacteriophage genetics, a molecular genetics thesis, precisely. He then spent two years in Switzerland for his post-doctoral studies, then came back to Francois Gros's laboratory, this time at the Pasteur Institute, still studying bacteriophages, until 1973-1974.

1973-1974. That was, according to Philippe Kourilsky, "the spark of genetic engineering." At the time, another molecular biologist, Alain Rambach, working in the lab of another Nobel prize, Francois Jacob, imagined on his own to produce a "vector." He was one of the very first men in the world to master this technique which was soon nicknamed "genetic manipulation." With all its Faustian and maleficient connotations, this genetic recombination technique, which Jacques Monod sometimes called "genetic engineering," consists in isolating and extracting from the genome a gene consisting of DNA fragments, and having a vector carry these DNA fragments to the heart of a bacterium's genetic machine. In most cases, the bacteria is the famed Escherichia Coli, strain K.12. As is known, this technique was to have considerable impact. Together with Pierre Tiollais, Alain Rambach thus began to develop one of the very first genetic-engineering vector systems. At the time, he was competing with a U.S. and a British team. "A few months later, the orientation being given, I got very much interested in that question," Philippe Kourilsky explained. This line of research soon became so extensive that Monod decided to clear a whole floor of the old institute and devote it to this type of studies. In 1975, the Pasteur Institute genetic engineering team was a full-fledged department. The year before, 1974, had seen the famed moratorium in which a group of researchers had asked for a temporary interruption of some of the research made in that direction. The Asilomar conference took place in 1975 and, "in the midst of extraordinary intellectual disorder," security measures for this type of research were decided.

"According to Philippe Kourilsky, "the creation of the Pasteur Institute genetic engineering department was a powerful kick-off for this methodology." The department included several groups and, by 1976, Philippe Kourilsky was heading one of them. This group grew and now consists of some 20 people. It even moved and is now in the immunology department.

Today, genetic recombinations have become commonplace, among scientists of course. Initially, however, genetic "manipulations" were not designed, as some may have believed, to manufacture mutant bacteria, a new bestiary of monsters, out of curiosity. Mostly, genetic engineering helped develop vital methods, "of prime importance," according to P. Kourilsky. Methods that would be used to purify genes, especially the genes of higher eucaryotes, like animals and man. "We used this method to gain access to what is a major problem in biology: the study of gene differentiation and regulation on a molecular scale. Now, until 1977, all this was strictly impossible in molecular terms. We could not purify genes. They were like an evanescent entity. Quite simply, study material was not available. Genetic engineering was the 'drilling' which got us out of this scientific deadlock."

The first goal of Philippe Kourilsky, who from then on worked in collaboration with Pierre Chambon of Strasbourg, was the gene of egg albumin, the large molecule forming most of what we call the egg white.

After, as he puts it, "completing the spadework" on the egg albumin gene with Pierre Chambon, Philippe Kourilsky decided to study something else and tackle a system of frightening complexity: that of the genes coding for major histocompatibility antigenes. The problem was as obscure as the words and concepts used to describe it. We are now talking about immunology, the discipline

which attempts to explain the ultrasophisticated biological and biochemical mechanisms of the defense systems of organisms. In man, these antigenes are related to the HLA system, and to the H2 system in mice. As it is difficult to experiment on man, Kourilsky and his lab staff decided to tackle the defense system of mice. The research orientation was similar to the one they had adopted previously for egg albumin. To isolate the genes, study them, determine their parts sequence, in brief to take apart the puzzle formed by the antigene. Their first great discovery was that these antigenes do not have a uniform structure. From one species to another, but also within a single species, these antigenes vary from individual to the next. As is known, this is the cause of graft rejection, and it is also the basis of many immunologic phenomena and, translated into molecular terms, it is what makes the difference between the Ego (which is you) and the non-Ego (the other). Histocompatibility (from histo meaning tissue, and compatibility) antigenes on the surface of each individual cells are different.

The first goal of Kourilsky's team, therefore, was to explain the mode of action of these antigenes, as well as the mechanism of their variation and, finally, the third basic objective of their research was to find why and how these genes expressed themselves during development. For, at first, they are absent from the egg-cell surface and, although they appear at a rather early development stage, somehow they represent development markers.

Philippe Kourilsky, Polytechnic graduate and biologist, is not only head of a department at the Pasteur Institute, a department which is also a CNRS [National Center for Scientific Research] research team as well as an INSERM [National Institute for Health and Medical Research] joint department, he is not only the advisor of the "Biotechnologies Development" Mobilization Program. He is also, still with Pierre Chambon, scientific advisor to Transgene, the private genetic engineering company headquartered in Strasbourg. He is both engaged in basic research and advisor to a company whose objectives are to take patents and, of course, to make profits.

And when you talk to him about money, he does not have the puritanical pursing of the lips of some who almost try to conceal that they supplement their salaries by giving advice to certain large pharmaceutical companies. "Earning money? Of course, it is never unpleasant to earn money. The contrary would be masochistic. Yet, for many researchers, what counts is to set up something that will work, that will succeed. Nobody likes failure. Researchers less than others. Theirs is a highly competitive trade. In applied research, what the researcher wants above all is to have his research succeed. Success of the undertaking is the criterion I would rank first..."

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FRENCH ONERA ACQUIRES U.S. SUPERCOMPUTER FOR RESEARCH

Paris AFP SCIENCES in French 26 Jan 84 p 11

[Text] Installation of a CRAY-1 at ONERA--The National Office for Aerospace Studies and Research (ONERA) has announced that as of mid 1984 it will install a computer system which includes in particular a CRAY-1, the most powerful computer currently marketed in the world.

The system, which will be installed at ONERA headquarters at Chatillon-sous-Bagneux, will be used to run the huge vector analysis programs necessary for the aerodynamic studies of complex aeronautical components. The aircraft manufacturers Marcel Dassault, SNIAS, MATRA and SNECHA who are associates in this operation, will use the system for the development of their own projects while ONERA reserves half the capacity of the machine for its own needs.

The CRAY-1 S 2000 to be installed at ONERA is an American computer (leased to the French national group Bull) having main memory capacity of two million words and a DPS8 Multics processor of ten billion characters. It will be connected to the equipment in place at the different partners by means of Transmic lines having a rate of one megabit per second.

According to ONERA's announcement, the computations made possible by the system's enormous processing capability will permit the designers to "increase considerably the optimization of equipment before undertaking wind tunnel, ground test and in-flight performance tests," and thus to achieve substantial savings.

ONERA points out that another CRAY-1 is used in France for scientific research: installed at the Ecole Polytechnique in Paris, it is shared by the National Center for Scientific Research, the National Education Office and the National Meterology Office.

ONERA also has a parallel small experimental computer system on which researchers at its centers in Toulouse and Chatillon-sous-Bagneux carry out long term studies linked to new data processing configurations.

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BULL STRATEGY INCLUDES IBM COMMUNICATIONS CAPABILITY

Paris ELECTRONIQUE ACTUALITIES in French 27 Jan 84 pp 1, 6

[Article by Philippe Marel: "An Agreement With Masstor Provides Bull With IBM Communications Capability"]

> [Text] Bull has just signed with the American company Masstor an agreement whereby Bull will distribute worldwide the Masstor hardware and software systems, allowing for the creation of very high speed heterogenous networks. This agreement marks a change in Bull's strategy which de facto recognizes the importance of the IBM standard in the market, the network allows the creation of a bridge between the two manufacturers.
>
> It constitutes an additional piece in the overall strategy that the group has been making public over the last several weeks.

After the mini and the micro, Bull has just revealed its strategy for large-scale computer systems. The group has just signed an agreement with the American company Masstor to integrate in its product offerings high speed local networks.

Masstor's solution is made up of major products. It includes, first of all, Massnet, a hardware and software system which permits the creation of local networks, which may or may not be heterogeneous, and permits data transfer between different computers integrated in the network.

The most significant technical aspect, at least with respect to IBM, is that Massnet, whose rate is 57 megabits per second, communicates completely with the first five versions of the ISO model but can also partially communicate with the two other versions.

In other words, a terminal on line with a Bull computer operating under GCOS III or GCOS 8 will be able to issue a print command to a printer connected to an IBM computer with MVS software in a way which is completely obvious to the user. This will be done through the network but also thanks to the MSPOOL software integrated in Massnet's technology.

Masstor's offer also includes, and this is its second stage, furnishing the SVSS (Shared virtual storage system) system which supports centralized data management and access control from various terminals, in heterogeneous or non-heterogeneous environments.

With its functions SVSS rounds out the concept implemented in Massnet.

It permits rational organization of data access through the possibility of permitting access to date or protecting it, depending on the user.

Masstor, a California company of 400 employees which had revenue of about 20 million dollars in 1983, also proposed a cartridge mass memory system for storing large quantities of data, the M 800. The company has already signed with Sperry agreements similar to the one with Bull and the agreement signed with Bull follows an agreement just concluded with Honeywell.

The local network used in Massnet was designed by Network Industries. Bull will ofer it to its clients, but control of the installation and maintenance of the network on site will be provided by Masstor.

But the Massnet technology not only permits communication with IBM systems but also with the Sperry 1100 under the OS/1100 system, the VAX under VMS and the Cyber of Control Data. But, given the dominance of IBM, the action of Bull is indeed directed at this market.

Mr Weber, President of Bull-Systems, who participated in the signing of the agreement, estimates, moreover, that even if his company refuses to consider IBM as the universal standard, it would nevertheless like to be able to communicate with it.

This is a position which, even if it reveals a reluctance to admit the actual monopoly of IBM in large-scale data processing systems, represents a considerable change on the part of Bull towards greater realism, which has become a necessity for a group whose ambition is to be among the top companies by the end of the decade. All the more so as the IBM threat is becoming more and more pressing with respect to the "Bunch" to which Bull belongs through its connections with Honeywell.

The group of "historic competitors" of IBM is seeing its share of the market progressively nibbled away by "number one" and by the stream of compatible products being developed for it. In France this has become, according to sources who know the problems of switching between IBM and Bull hardware, a change more and more frequently from Bull to IBM rather than vice-versa.

Bull, whose share of the computer market, in France could be placed at 1,500 large and medium-size systems and 5,000 mini and small systems, is having more and more difficulties in protecting its share of systems installed in the private sector.

9865
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THOMSON SEMICONDUCTORS BIPOLAR IC STRATEGY TO 1986

Paris ELECTRONIQUE ACTUALITES in French 24 Feb 84 pp 1, 15

[Article by J.-P. Della Mussia: "Thomson Semiconductors Will Introduce 2-Micron Bipolar Integrated Circuits Starting in 1985"]

[Text] After deciding to invest again in digital bipolar integrated circuits four years ago, Thomson Semiconductors is now producing some circuits (16-Kbit 35-ns PROM; 2901-C microprocessor) that are among the fastest in the world, and it is following an ambitious technological development plan that should enable the company, now a technological imitator, to become an innovator by 1985 or 1986.

In 1986, indeed, the company should have acquired a 1.25-micron technology three years ahead of its products, a lead which the company feels it has to have, as it needs two years to develop models, macrocells and innovative products based on a given technology, and one year for a "running-in" production period.

For the time being, having started production based on its so-called HBIP-2 3-micron technology late in 1983, Thomson is preparing for industrial production of the following 2-micron generations.

29116-A Microprocessor Next September

Introduction of a 16-Kbit 35-ns PROM last October, sampling of the 2901-C microprocessor a few days ago, sampling of the 22116-A microprocessor next September: Thomson Semiconductors has almost caught up with world leaders in digital bipolar circuits. The next stage will be more difficult: the company must develop technologies that are not yet used by the industry worldwide to support innovative circuits or second-source circuits almost as soon as they are introduced.

Thomson Semiconductors entered the advanced bipolar technology era in 1982 with a 6-ns technology called HBIP-1/4, with geometric patterns as small as 4 microns and with lateral junction isolation. Among other things, this technology enabled the company to offer a 16-Kbit PROM with a 24-mm^2 area. Since then, of course, this technology has been improved: leaner patterns have resulted in a 10-percent gain on linear dimensions; a further reduction

consisting of thinning, localized migrations and redesigning for compatibility was then implemented to gain 20 percent, bringing the PROM area down to only 18 mm^2.

However, mere reductions are no longer adequate beyond 20 percent. This is why the HBIP-II technology was introduced in 1983; it is a technology using 3-micron patterns with mixed lateral isolation through junction and oxide isolation. This technology, which is like the IMOX-II technology of AMD [Advanced Micro Devices] is now implemented on the 16-K/35-ns PROM which covers only 12 mm^2 (it is the smallest in the world) and on the 2901-C microprocessor. Its patterns will be reduced progressively, to reach close to 2 microns in 1985. It will be used, among other things, to integrate the A version of the 29116 microprocessor and probably a 64-kbit PROM early in 1985. It is also expected to be used as early as September on a new Thomson 16-K/25-ns PROM.

The actual internal propagation times made possible by the HBIP-II technology range from 2 ns to a maximum of 4 ns, and its consumption is of the order of 0.75 mW per logic operator, compared with 4 to a maximum of 6 ns and 2 mW for the HBIP-I technology. This improvement was due, among other things, to achievements such as a 1.5-micron epitaxial layer, self-alignment, the reduction of stray capacities, the presence of double-base transistors (two interconnection levels) and the reduction of geometries.

First HBIP-III Prototypes

As we said, Thomson is also developing technologies for which the industry does not yet have any prospects, either with respect to the internal structure (TTL [transistor-transistor logic], ISL [integrated Schottky logic], STL [Schottky transistor logic] or ECL [emitter-coupled logic]) or with respect to the products that will use them. This research, therefore, is purely technological for the time being and all available internal structures are evaluated as possible supports. The final decision, as far as structures are concerned, will be made by the marketing department based on the speed/integration-level/price requirements (depending on the manufacturing difficulty) of the circuits needed by the market.

Therefore, Thomson is now developing two technologies: the first one is called HBIP-III-A and uses 2-micron patterns with 1-2 nx maximum per internal operator--it will be available for new products to be introduced during 1985-1987. The second one is called HBIP-III-B and will use 1.25-micron patterns with 1 ns maximum; it is expected to be operational early in 1986. For the time being, only the former is involved in active research on prototype circuits that already exist in the laboratory.

The end goal of the HBIP-III-A technology is to achieve lateral isolation using only oxide, which means that an epitaxial layer of no more than 1.3 microns must be obtained. This is not a revolution compared with what has already been imagined, but to achieve this industrially, with acceptable outputs and reliabiliby, will be a progress. The three-base transistors will be walled on three sides. Polycrystalline silicon will be used, among

other things, for contacts, to obtain resistors with low stray capacities, and to add an additional interconnection level.

The HBIP-III-B technology, for its part, will use 1.25-micron patterns with epitaxial layers of the order of 1 micron, and the edges of its boxes will be cut straight instead of presenting the traditional bird's bill cut. This will make it possible to reduce transistor areas and stray capacities but, first, expertise must be achieved in the engraving of 1.5-micron wide and 3-micron thick lines (work has already started on this jointly with LETI [Electronics and Data-Processing Technology Laboratory]). A circuit-planarization program will also be started for this circuit generation.

If the technological road that must be followed until 1986 is quite obvious, the same is not true of the type of structure to be adopted for future circuits: ECL, STL, ISL or TTL. Indeed, starting in 1985-1986, bipolar technology will have to compete with CMOS [complementary metal-oxide semiconductor] circuits on the one hand, which may be slower but make possible greater integration densities, and with GaAs circuits on the other hand, which will remain more costly for a long time (or, if you prefer, cannot be realized on large chips) but which are potentially faster. If CMOS circuits make spectacular progress, the relatively slow high-integration-density bipolar structures would then become somewhat less interesting. On the other hand, if GaAs technology were to become industrial soon, it would be at the expense of ECL structures.

A priori, if we disregard heat-dissipation problems, chips of several tens of square millimeters obtained through ECL technology could resist for a long time the thrust of GaAs technology, as the former can unite on a single circuits functions that would require several chips to be integrated in the GaAs technology, with all the reliability and propagation-time losses that this supposes. On the other side of the scale, the situation is not quite as clear. What circuits will the market require? Will it accept circuits with only a few tens of thousands of transistors but 2-3 times faster than CMOS circuits, or will it prefer to be able to integrate some 200,000 CMOS transistors on a single chip as early as 1985?

Up to 10 W Per Chip

In this discussion, we have overlooked the fact that the power dissipated per chip does not exceed a few watts, a restriction which is a serious obstacle for GaAs integrated circuits but which, as experience as shown, is only a punctual obstacle for bipolar or CMOS circuits. Actually, since about 1970, we have always heard technologists speak of a "forthcoming" restriction of integration, due to the dissipation rate per chip. Yet, in actual practice, this restriction has affected only certain ECL circuits, for instance complex gate arrays. There are three reasons for this gap between theory and practice:

- as circuits become more complex, the importance of the utilization coefficient of each of their functions decreases: with well-designed circuits (functions at rests do not use power), the average dissipation of the chip

may amount to only 10 or 20 percent of its purely theoretical maximum dissipation, corresponding to the case when all parts of the circuits operate simultaneously;

- consumption per gate decreased, in time, in the same proportion as density of integration;

- the heat dissipation potential of the chips has not been fully taken advantage of: technologists are reluctant to acknowledge large heat dissipations; but AMD, for instance, is said to have acknowledged that future bipolar circuits could dissipate up to 10 W. For our part, we are convinced that 25 W could be reached one day with radiator-housings, for the simple reason that 25 W have already been obtained with linear integrated circuits; there has been no large-scale research in recent years to try and make up for what we consider is lost ground.

Thomson/Saint-Egreve has made theoretical comparative evaluations of the various structures already mentioned with the HBIP-III-A technology. (Warning: the figures given below are no longer "objective" maximum industrial figures, but calculated figures). With "low-speed/large-integration" structures, STL always remains face to face with ISL, with comparable useful characteristics as far as consumption (200 μW/gate), speed (about 0.65 ns) and density (615 operators/mm^2) are concerned, the main difference lying in the difficulty of manufacturing (2 Schottky diodes for STL, compared with strong sensitivity to the epitaxial layer thickness for ISL).

For high speed/slow integration, ECL is the only logic that will do, as it has a propagation time of 0.45 ns, TTL being too slow (0.9 ns); yet, we should note that 0.45 ns yields a consumption of 400 μW per operator, i.e. twice the consumption of the previous structures, and that ECL has a density of only 94 operators per mm^2. With ECL, it is also possible to obtain compromises that are faster and consume more.

To choose its test vehicle, Thomson/Saint-Egreve calculated a merit factor for each of the various structures; it is defined as the ratio of the product of the density by the logic swing and the product of the power consumption by the propagation time. This ratio reaches 1025 with STL, 783 with TTL, 703 with ISL and 207 with ECL. Thomson thus selected STL. This selection, of course, was made only for laboratory tests. A marketing selection should introduce weighting factors for these parameters, plus a manufacturing difficulty factor, an important factor if we consider that Texas Instruments gave up some STL circuits because of poor yields (Thomson stated it had solved the problems inherent to STL).

The first results obtained by Thomson with its STL structure in HBIP-III-A technology are truly attractive. In the range from -55°C to +150°C, the propagation times obtained did not exceed 1.2 ns on the average for a 200 μW consumption. At 25°C, they never exceeded 1 ns on a ring oscillator with four outlets per stage, one of which was under load. For a 200 μW consumption, the best result obtained was 0.52 ns. By increasing consumption to 600 μW, 0.27 ns could be reached at 25°C: this is a world STL record. And this high-consumption STL may well prove to be the means of protecting bipolar technology against CMOS circuits.

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CONCLUSIONS OF NETHERLANDS REPORT ON DOMESTIC TECHNOLOGY

Rotterdam NRC HANDELSBLAD in Dutch 13 Feb 84 p 13

[Article: "Netherlands in Increasingly Disadvantaged Position in Technology"]

[Text] The Hague, 13 February -- This afternoon, after one and a half years of study, the working group on technology policy presented its final report: "Toward a Technology Policy Directed Toward the Market Sector." The task of the working group, established on 15 August 1982 by the then Minister of Economic Affairs Jan Terlouw, was "to make proposals in the short term about both the substance and the structure of the implementation of a future technology policy directed toward the market sector."

As Terlouw wrote, the oulining of such a technology policy was important for the success of the Dutch re-industrialization, a path the government had turned to in 1980 upon advice about Dutch industry from the Scientific Council for Government Policy [WRR] and the Advisory Committee on Industrial Policy, better known as the Wagner Committee.

This committee specifically stressed the important of technology in the re-industrialization policy. In its further reports, the Wagner Committee always noted the important of a coupling of policy for technological and economic development. And the emphasis was placed on the involvement of business and industry in the technology policy, on the greater market orientation of research institutions, and on coordination of technology policy by the administration.

Through a technology policy, the government wants to make a greater contribution to the competitive power of Dutch business and industry "by actively stimulating the development and application of technological knowledge and the creation of conditions to that effect."

On 8 April 1983, the Council of Ministers appointed the minister of economic affairs as project minister for technology policy and, at the same time, approval was given to the establishment and composition of the technology policy working group.

Crucial

In its nearly 100 page long report, the working group started by noting that the exact significance of technology for economic growth cannot be measured. Economic growth is dependent on countless factors -- training, scale effects, and so forth --, the individual contribution of which is difficult to determine. Econometric research has not produced any results yet, other than the fact that the crucial role of technology is stressed unanimously. What is even more difficult to trace is the relationship between technology and jobs.

There is insufficient insight into how technological development has influenced jobs and will continue to do so. It is certain that for an open economy like the Dutch one, not to apply new technologies or to do so at a reduced rate would ultimately lead to a loss of jobs.

In the past 10 years, the countries of the EC have not been very successful in terms of a rapid turning to new technological developments; quick reaction partly determines the success of industrialized countries in achieving their socio-economic goals.

Since 1963 the relative share of the EC in the trade of high technology products has declined relative to its main competitors: Japan and the United States. The reasons: a segmented market structure, a lack of dynamic competitive relationships, an industrial policy directed toward preservation, and insufficient interaction between research financed by the government and the market sector.

The Netherlands has its specific problems. Thus the industrial character is determined by five large multinational industries, a relatively large number of foreign companies located here and a very large number of smaller enterprises which mostly do not have their own production package.

Increased Rate

The multinational organizations have a tendency to transfer Research and Development [R and D], and ultimately production, to those locations where large, well to do and advanced markets are available. As a result, the position of small industrial countries like the Netherlands is becoming increasingly unfavorable.

But governments also play an important role. An analysis of the great discoveries of this century clearly illustrates this. The intensity and scope of the involvement of governments in the development and application of new technologies, especially through financing and a number of other regulations which stimulate innovation, are new.

Consequently, the rate of development is increased, which can only be bought at the price of a greater allocation of financial resources. This can be justified on the grounds that in many cases whoever is first in putting a new product on the market will reap the largest fruits in terms of added value and jobs.

The Netherlands will have to intercept its share of the small volume through (international) cooperation. According to the working group, the problem of lack of funds could be overcome in a European context through pooling of the interests of European companies and of national R and D funds. This would then also bring today's futureless intra-European R and D race to an end.

A further liberalization of the European market will also have a favorable impact, for the Netherlands but also for the other member states, on the choice of multinationals for the location of development and production of technology products.

Somber

Since the first oil crisis, a substantial decline has taken place in the Netherlands in the rate of growth and renewal of the capital goods supply. As of 1980 there was even an absolute drop. Over the last 3 years, the whole macro growth of the capital goods supply since the first oil crisis has been nullified. To a substantial extent, new technologies are to be found in capital goods.

Furthermore, large sections of the economy find themselves in an unfavorable capital position. The recovery of profits leads first of all to an improvement of that capital position and not to renewal and expansion. If the terms "shortage" and "obsolete" apply to the production factor capital, the words "glut" and "high grade" apply to the production factor labor. Calculations show that in the coming years the working population will increase by 70,000 labor years per year. A decline will occur only around the turn of the century (calculations CPB [expansion unknown]).

The Netherlands has the most highly trained working population in Europe. However, unfavorable aspects of economic growth power are: a strong orientation toward the quaternary sector (nearly 40 percent), a reduced knowledge of languages, and declining mobility.

The Netherlands has high export quotas, even with adjustments made for natural gas. As a result, Dutch business and industry are constantly faced with tough competition. If they want to maintain their position, a permanent sizable effort will be required in the area of product and process renewal, according to the working group.

The somber picture, wrote the working group, lies largely in the extension of earlier analyses from a more macro-economic and general industrial-political approach. The technological point of impact brings a number of specific problems to the fore.

Business and industry judge technological change processes primarily from the point of view of a medium term trade policy. Hence, the government will have to ensure a favorable financial-economic climate, plus the financial and psychological climate in which the possibilities for risky, innovative entrepreneurship is greater. Hence, an effective technology policy should be part of an integrated socio-economic policy and a far-sighted re-industrialization policy.

According to the working group, given the required knowledge, experience and mentality and the dynamics within these, which is necessary to have a successful impact on technological developments, a differentiated, decentralized technology policy supported by the market sector is necessary. The role of the government in this respect is to create conditions, to mobilize and to stimulate.

Research and Development

The working group writes that research and development are among the activities that can make vital contributions to coping with current and future social and economic bottlenecks. In the Netherlands expenditures for R and D run reasonably parallel with the gross national product. But compared to other countries, the development of R and D as a whole is not favorable.

In various countries, expenditures for R and D have risen substantially (plus 0.7 for Japan; plus 0.6 for Germany). Government spending for R and D for companies has also risen in the Netherlands, but other countries have higher percentages for these resources which are directly transferred to the market sector. In the Netherlands, since 1975 the GNP has grown an average of 1 percent less than the OECD average, which in the international context means a standstill.

Furthermore, according to the working group R and D personnel costs for academics are still high in the Netherlands. One should not forget a number of retrenchment measures which were agreed on in the government agreement but have not yet been integrated in the budget.

The seventies have shown a decreasing share of R and D expenditures by business and industry. According to the working group, recent figures indicate a modest turnaround since 1978, but in other countries what has happened since then is an acceleration in the increase of the share of business in total R and D spending.

The five large enterprises in the Netherlands (Shell, Akzo, Philips, Unilever and DSM [expansion unknown]) account for 70 percent of total R and D spending by business and industry. These funds are partly spent outside the Netherlands. This picture also appears in other countries, but it is particularly strong in the Netherlands. Enterprises with up to 500 workers account for only 11.1 percent of the total R and D spending. R and D efforts made by companies with fewer than 50 workers were not recorded. In the Netherlands, the government contributes only 9 percent of all R and D expenditures in the economy. This percentage is increasing at this moment in other countries, through fiscal measures.

Small and Medium Sized Enterprises [KMO]

Small and medium sized enterprises form a substantial component of the industrial production structure. In the Netherlands, the number of companies with more than 50 workers exceeds 3,000. It is estimated that the potential role of KMO's in the renewal process is big, as is their role in the development of jobs. In this regard, the working group on technology policy has turned

its attention to the stimulation of innovative entrepreneurship and to the stimulation of knowledge infrastructures which are keyed to the wishes, the needs and the possibilities of the KMO's.

According to the working group, what is primarily at issue for the KMO entrepreneur is the gathering of information and the removal of bottlenecks which hinder application and the development of new products.

KMO's account for only a very small part of the overall R and D costs, because in the eyes of the entrepreneur the money can often be better spent on short term improvements of the means of production. The entrepreneur does not see enough starting points to take advantage of subsidies. The working group expects that the Regulation to Stimulate Innovation (INSTIR, effective as of 1 October of this year) will change this.

KMO entrepreneurs see the supply of information as opaque, inadequate and dispersed.

According to the working group, this problem can be effectively solved only through a system in which instruction, research and training are coupled to each other. In the opinion of the working group, such a cohesive system of knowledge infrastructure (per group of companies, an institution to which a company can address its questions, accessible at a regional level) will have to be set up and function under the responsibility of the branches of industry.

Furthermore, according to the working group, management in general in the KMO's should be better supported.

Areas of Emphasis

The technology policy pursues the development of the management of the so-called areas of emphasis, which earlier committees pleaded for: where do knowledge intensive, high technology activities connect with opportunities in the Netherlands and what is their impact on international technological developments?

This is a complicated area, which falls between long term research and activities which offer great opportunities in the short term. In other words, combinations of fruitful areas of research and clearly defined social needs (possibly new products in new industrial sectors). In tackling these areas of emphasis, forms of cooperation which have not ordinarily been used much up to now are needed.

In the opinion of the working group, the technological areas of emphasis will require an additional financing instrument. What is involved in tackling the technological areas of emphasis is to gather all the parties involved around a field of activities which is recognizable by everyone. Goal: to achieve concrete activities by the enterprises in the short term. In this respect, they will also have to take a look at cooperation among enterprises (sometimes completely different ones), because the creation of a product often takes place via a chain of complementary companies. Smaller companies should be involved in this.

Research Institutions

In conclusion, the working group devoted a chapter to universities, colleges and major Technological Research Institutes [GIT's]. With regard to these institutions, the working group noted that although in recent years they have become more open to examining social problems, a strengthening of this is still needed, whereby -- in the opinion of the working group -- a more active input from the market sector is required. University research forms an enormous reservoir of knowledge, is characterized by long term goals and is also "critical and independent."

The working group sees the task of the university primarily in terms of long term strategic research. This will require the appropriation of a larger share of the money flow.

In the United States, universities and companies sign "multi-million dollar" cooperation agreements about long term research in specific areas, such as computers. In the Netherlands, such cooperative ties do not or hardly exist.

But furthermore, there is still more room for short term contract research for universities as well as technical colleges and GIT's. According to the working group, research programs directed toward innovation fill a pivotal function in order to strengthen the relationship between business and the university world. In the opinion of the working group, the initiative will have to come both from colleges and universities.

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SWEDEN FUNDS BASIC RESEARCH WITH INDUSTRIAL APPLICATIONS

Stockholm DAGENS NYHETER in Swedish 10 Feb 84 p 9

[Article by Eric Dyring]

[Text] A new research council for basic technical research is one of the new items in the government's upcoming bill on research. DAGENS NYHETER can disclose that grants totaling approximately 20 million kronor are being proposed for 1984-1985 to fund new research projects which are not regarded as pure basic research but which are too much within the field of basic research to be interesting from the industrial standpoint.

This is an old problem that the government wants to solve. A number of research projects have wound up in a no man's land between the Natural Science Research Council and the STU (National Board for Technical Development). It has been claimed that applications have been kicked back and forth between those two providers of grants until they have finally landed in the middle with no money from anybody.

This problem has been studied and discussed for several years.

The STU has been working with faculty planning boards of the technical colleges in an attempt to find solutions. As a result, the STU recently decided to invest 5 million kronor in basic technical research beginning this spring, and the notice will be published very shortly. So if the government bill passes, 20 million kronor will be available during the coming fiscal year.

Interesting Point

One interesting point is that no new organization will be set up to handle the money. The grants will be channeled through the STU.

A special council for basic technical research is one more indication of the government's concentration on basic research in its upcoming bill. There will also be more fresh money for the three other research councils: those for humanities and social sciences, medicine and natural sciences.

In an interview with DAGENS NYHETER on 28 December, Minister Ingvar Carlsson announced that sectoral institutions will be given a greater opportunity to support basic research.

He also welcomed the idea of active support for basic research by industry. The subject of a research fund to be established by industry is therefore open for discussion.

"Development Boom"

An important objective of the research bill is to create a working balance between science's own need to develop and society's need to have current problems solved with the help of research.

The postwar boom in research and development (R&D) has turned out to be mostly a boom in development. When Sweden made a new try at research policy at the end of the 1970's, an effort was made to find a golden mean between what research wanted to do and what society wanted it to do. The government is now going further along that path, but it is placing a clear emphasis on basic research.

The research bill has been disseminated for comment among universities, technical colleges, government authorities, and unions.

Without exception, the reception has been favorable. The research sector liked the bill's appropriations. Of course it would like to have more money. But against the background of the winds of economic tightfistedness blowing through the public sector's finances, that economic fallout is being greeted with gratitude.

Naturally, not everyone is pleased. Energy research is being dropped from the "A team" of priorities, and this has brought criticism from certain quarters. The new members replacing energy on the A team are electronics and biotechnology.

11798
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SWEDISH VENTURE CAPITAL FIRMS FUND OPTICAL SWITCH INVENTION

Stockholm DAGENS NYHETER in Swedish 9 Feb 84 p 8

[Article by Kerstin Kall]

[Text] Five Swedish venture capital firms have banded together to invest in a new company established to launch a new invention. The company is called the Opti Sensor Corporation, and the invention, which will now have nearly 2 million kronor for its takeoff, is an optical "push button" for a new switching method.

The many new venture capital firms in Sweden have invested very cautiously until now: their "venture money" has gone into the development of existing firms.

"This is a genuine startup on the American pattern," says Christer Dahlstrom, who resigned as managing director of Sapos in Solna on 1 February to get this new firm started.

The attempts to stitch together a number of venture capital firms to support the new invention were in progress throughout last fall.

Formation of the firm is now as good as arranged, and the five firms sharing in the venture are Nord-Invest of Goteborg, Start-Invest, Ventech, Ventura, ASEA [Swedish General Electric Corporation] Innovation, and Growth Corporation (the State Holding Company firm).

Smart Invention

The firm already has a cooperation agreement with Addo for product development and a licensing agreement with Electrolux, and it is engaged in negotiations with L.M. Ericsson. ASEA is already involved and investing money in the firm.

Arne Bergstrom is the inventor, and he is now receiving considerably more for his idea than the 1,000-kronor notes usually invested by the STU [National Board for Technical Development]. What he has invented is a control system based on interaction between light and electronics. Instead of pressing buttons for switching operations, one barely touches a flat glass plate with small, faintly glowing points of light. The system is extremely insensitive to external influences.

It is therefore expected to come into use particularly in sensitive environments: for example, in hospital equipment and in dangerous environments where the danger of explosion exists.

11798
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BRIEFS

BRITISH 'PRUTEEN' TECHNOLOGY BARTERED TO USSR--According to information given to the British press by David Warburton, labor union leader from the British chemical industry, methanol is at the center of a barter agreement which the ICI /Imperial Chemical Industries/ group is negotiating with the Soviet Union. Under the terms of the proposed agreement ICI would provide the technology for the production of methanol from natural gas and for the production of animal feeds obtained from that methanol (they are proteins of the "Pruteen" type currently produced by its giant fermenter at Billingham). A plant requiring an investment of some 160 million pounds will be built in the Soviet Union which, in exchange, will supply methanol to the British company. The current negotiations are connected with the ones mentioned last year (see issue of 31 October 1983, pg 5) and dealing with cooperation between these two partners in the agricultural sphere. /Text/ /Paris CHIMIE ACTUALITES in French 23 Jan 84 p 3/ 8796

FRAMEWORK FOR FRENCH SALES TO USSR--Soviet purchases of French superphosphoric acid and lubricants are expected to increase appreciably. This is the first consequence in the chemical industrial sphere of a cooperation agreement which Pierre Mauroy and Ivan Arkhipov, first deputy chairman of the USSR Council of Ministers, signed on 3 February, in Paris, for the purpose of correcting the trade imbalance between their two countries as a result of gas purchases. On the previous day Arkhipov, who has been on a visit to France since the 30th of January, went to the Rhone-Poulenc plant of Peage-de-Roussillon where he met with Loik Le Floch-Prigent, president of the nationalized company. Mr Achille, president of the Chemical Industries Union, said on 6 February that these purchases will mostly take place under the terms of already existing agreements between various companies and the USSR. "There are already framework agreements," he said, "the question now is to slightly increase their performance." In fact such an agreement exists with Rhone-Poulenc, a company which, as we know, has had relations with the USSR for 25 years. "During that period," notes a communique issued by the group, "our business dealings have known a continuous growth which resulted in a balanced trade flow of about 1.5 billion francs in 1983 and in the purchase by the USSR of 23 units utilizing processes developed by Rhone-Poulenc" (10 of them in the last 10 years representing some 3 billion francs). "Prospects in the coming years are encouraging," the communique adds, with contracts (for goods and equipments) expected to be worth "several billions of francs" in a near future. /Text/ /Paris CHIMIE ACTUALITES in French 13 Feb 84 p 4/ 8796

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